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EXAMINER	
DANIELS, MATTHEW J	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/659,006	BAJOREK, CHRISTOPHER H.	
	Examiner	**Art Unit**	
	MATTHEW J. DANIELS	1791	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 February 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-16,18,19 and 21-24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-16,18,19 and 21-24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *2/11/08*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

1. **Claims 1, 2, and 8** are rejected under 35 U.S.C. 102(b) as being anticipated by Krauss (Ph.D. Dissertation, University of Minnesota, 1997). **As to Claim 1**, Krauss teaches a method, comprising:

heating a stamper and a resist film (page 82, lines 17-21);

imprinting the stamper into the resist film (pages 82-84);

separating the stamper from the resist film before the resist film is cooled below approximately a glass transition temperature of the resist film (page 83, lines 10-12); and

cooling the resist film below the glass transition temperature after the separating (inherent). **As to Claims 2 and 8**, Krauss provides both the stamper and single resist layer (PMMA) heated to the glass transition temperature (pages 82-83).

2. **Claims 1-4, 8, 11, 14, 15** rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Tan (J. Vac. Sci. Technol. B 16(6) Nov/Dec 1998, pp. 3926-3928). **As to Claim 1**, Tan teaches a method comprising:

heating a stamper and a resist film (page 3927, right col.);

imprinting the stamper into the resist film (Fig. 1, Fig. 2);

separating the stamper from the resist film (Fig. 2);

cooling the resist film after separating (inherent in that the material is subsequently analyzed, Figs. 3-4).

Tan does not explicitly teach "separating the stamper from the resist film before there is any substantial cooling of the resist film". However, in view of the fact that the stamper (the roller) operates continuously while being heated by a lamp (Fig. 1) which provides a mold temperature above the glass transition temperature, it would have been inherent that the resist in contact with the stamper would still be at a temperature above its glass transition temperature when the stamper separates from the resist. In the alternative, however, is this limitation would have been prima facie obvious over Tan's teaching to optimize the temperature of both components (stamper and resist) within a wide temperature range (page 3927, left column). Therefore, in the alternative, the stamper (roller) temperature and the resist temperature represent result effective variables that one would optimize to produce high pattern fidelity and good separation.

As to Claim 2, Tan teaches that the temperature is a result effective variable, and that temperature of the platform was varied up to 200 C (page 3927). Since the roller is always above the glass transition temperature (page 3926, right column), the claim is anticipated or obvious over the Tan method. **As to Claims 3, 4, and 8**, see Figs. 5 and 2 for the structures and configurations. **As to Claim 11**, since the stamper (roller) and platform are heated to different temperatures and using different heating means (Fig. 1), they would inherently be separately heated. **As to Claims 14 and 15**, Tan teaches that the stamper (roller) is heated to a first

temperature above the glass transition temperature of the resist (page 3926, right column) while the resist is heated on the platform is at a temperature of around 50 C (page 3927, right column). Since the resist is contacted by the stamper (roller) heated at the first temperature, it is submitted that it would have been inherent that the resist would have been further heated to the first temperature.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. **Claims 3, 4, 10, 11, 12 and 13** are rejected under 35 U.S.C. 103(a) as obvious over Krauss (Ph.D. Dissertation, University of Minnesota, 1997). Krauss teaches the subject matter of Claims 1 and 2 above under 35 USC 102(b). **As to Claims 3 and 4**, although Krauss does not expressly teach a wafer or a trench/plateau pattern used with the resist described in the rejection of Claim 1, these aspects of the invention would have been obvious additions to the Krauss process. For example, Krauss teaches a wafer with the resist on page 87 and trenches and plateaus on page 91. As to Claim 10, Krauss teaches heating prior to imprinting (page 82), and any order of heating the two components prior to the imprinting process would have been obvious. **As to Claims 11 and 12**, Krauss teaches heating to the glass transition temperature (pages 82-83). Although Krauss is silent to the number of heating devices, and thus heating the

stamper and resist separately, heating the two components separately would merely separate two process steps already disclosed by Krauss. Separation of parts or steps would have been obvious to the ordinary artisan practicing the Krauss method. **As to Claim 13**, it is submitted that any step of imprinting would obviously require placement of the stamper in close proximity to the resist in order that it is subsequently imprinted.

4. **Claims 5 and 6** are rejected under 35 U.S.C. 103(a) as obvious over Tan (J. Vac. Sci. Technol. B 16(6), Nov/Dec 1998, pp. 3926-3928) in view of Chou (USPN 5956216). Tan teaches the subject matter of Claims 1 and 11 above under 35 USC 102(b), or in the alternative, under 35 USC 103(a). **As to Claims 5 and 6**, Tan is silent to the removing the resist and disposing a magnetic layer. However, Chou teaches selectively removing the resist film to form a pattern of areas that do not have the resist film thereon (Fig. 4C), and disposing a magnetic layer in the areas that do not have the resist film (Fig. 4D, Item 48). It would have been prima facie obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of Chou into that of Tan because Tan suggests that the process should be used for data storage devices (Figs. 3 and 4), and Chou provides a process for making a data storage device.

5. **Claim 7** is rejected under 35 U.S.C. 103(a) as being unpatentable over Tan (J. Vac. Sci. Technol. B 16(6), Nov/Dec 1998, pp. 3926-3928) in view of Chou (USPN 5956216), and further in view of Chou (USPN 6309580). Tan and Chou (‘216) teach the subject matter of Claim 5 above under 35 USC 103(a). **As to Claim 7**, Tan and Chou (‘216) appear to be silent to the deliberate etching of the base structure using the patterned resist film. However, Chou (‘580)

teaches that recesses may be formed in the substrate (Fig. 8 and 10:41-51) using a patterned resist film produced by imprinting (Figs. 1A-1D). It would have been prima facie obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of Chou (‘580) into that of Tan because Tan suggests the formation of data structures, and because the improvement of Chou ('580) would mechanically secure the deposited material into the substrate, rather than to the surface.

6. **Claims 10, 12, 13, and 16** are rejected under 35 U.S.C. 103(a) as obvious over Tan (J. Vac. Sci. Technol. B 16(6), Nov/Dec 1998, pp. 3926-3928). Tan teaches the subject matter of Claims 1 and 11 above under 35 USC 102(b), or in the alternative, under 35 USC 103(a). **As to Claim 10**, although Tan is silent to a particular order of steps, any order of heating would have been obvious since there would be no material affect on the method by the rearrangement of the order of heating the two components. **As to Claim 13**, in the rolling process of Tan, the stamper (roller) would be placed in closed proximity to the resist while the resist is approximately at the imprint temperature in order that the resist is subsequently imprinted (Figs. 2 and 5). **As to Claims 12 and 16**, Tan optimized the temperature of both components. Since the platform was heated in some cases to 200 C (page 3927, left column), and the stamper was heated to temperatures between 120 and 200 C (page 3927, left column), it would have been obvious to provide temperature combinations such that the stamper and resist are separately heated above the glass transition temperature such that the temperature of the resist is higher than that of the stamper.

7. **Claim 9** is rejected under 35 U.S.C. 103(a) as obvious over Tan (J. Vac. Sci. Technol. B 16(6), Nov/Dec 1998, pp. 3926-3928) in view of Heidari (J. Vac. Sci. Technol. B 18(6), Nov/Dec 2000, pp. 3557-3560). Tan teaches the subject matter of Claim 1 above under 35 USC 102(b), or in the alternative, under 35 USC 103(a). **As to Claim 9**, Tan is silent to the plurality of resist layers. Additionally with respect to (b), Heidari teaches a multilayer resist scheme (page 3559) used with nanoimprint lithography and a lift-off process. It would have been prima facie obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of Heidari into that of Tan because (a) the references demonstrate that both resist configurations are known and use of each resist independently with a nanoimprint method suggests that these resist configurations are substitutable materials in the nanoimprint art, and (b) Tan suggests the process for use in making compact disks, and Heidari teaches a multilayer resist scheme directed to use in compact discs (Section III, page 3557).

8. **Claims 18 and 21** are rejected under 35 U.S.C. 103(a) as obvious over Tan (J. Vac. Sci. Technol. B 16(6), Nov/Dec 1998, pp. 3926-3928) in view of Heidari (J. Vac. Sci. Technol. B 18(6), Nov/Dec 2000, pp. 3557-3560). **As to Claim 21**, Tan teaches a method comprising:

heating a stamper and a resist film (page 3927, right col.) to at least the transition temperature (page 3926, right col., 120-200 C, page 3927, left col., “varied between room temperature and 200 °C”);

imprinting the stamper into the resist film (Fig. 1, Fig. 2);

separating the stamper from the resist film (Fig. 2).

Tan does not expressly teach (a) a plurality of resist layers, (b) "cooling the resist film to a second temperature above room temperature", and (c) "separating the stamper from the resist film at the second temperature above room temperature". However, with respect to (a) the temperature of both the platform/resist and the stamper (roller) are result effective variables in order to produce high pattern fidelity, and when the stamper (roller) is at a temperature lower than the resist, the resist would cool to the temperature of the stamper immediately before the two components are separated. Additionally, with respect to (c), in view of the fact that the stamper (the roller) operates continuously while being heated by a lamp (Fig. 1) which provides a mold temperature above the glass transition temperature, it would have been inherent that the resist in contact with the stamper would still be at a temperature above room temperature when the stamper separates from the resist. These limitations would have been prima facie obvious over Tan's teaching to optimize the temperature of both components (stamper and resist) within a wide temperature range (page 3927, left column). Therefore, in the alternative, the stamper (roller) temperature and the resist temperature represent result effective variables that one would optimize to produce high pattern fidelity and good separation.

Additionally with respect to (b), Heidari teaches a multilayer resist scheme (page 3559) used with nanoimprint lithography and a lift-off process. It would have been prima facie obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of Heidari into that of Tan because (a) the references demonstrate that both resist configurations are known and use of each resist independently with a nanoimprint method suggests that these resist configurations are substitutable materials in the nanoimprint art, and (b) Tan suggests the process

for use in making compact disks, and Heidari teaches a multilayer resist scheme directed to use in compact discs (Section III, page 3557).

As to Claim 18, in view of Tan's teaching in Fig. 5, it would have been obvious to dispose the resist above a wafer or substrate prior to heating.

9. **Claim 19** is rejected under 35 U.S.C. 103(a) as obvious over Tan (J. Vac. Sci. Technol. B 16(6), Nov/Dec 1998, pp. 3926-3928) in view of Heidari (J. Vac. Sci. Technol. B 18(6), Nov/Dec 2000, pp. 3557-3560), and further in view of Schneider (Applied Physics Letters, Vol. 77, No. 18, October 2000, pp. 2909-2911). Tan and Heidari teach the subject matter of Claim 21 above under 35 USC 103(a). **As to Claim 19**, Tan is silent to the etching and disposing of a magnetic layer in the regions where the resist is absent. However, Heidari teaches a lift-off process using nanoimprint lithography, and Schneider teaches that it is known to use a lift-off process and deposition of a magnetic layer. In combination with the modified method of Tan, the Schneider process would provide magnetic nanodisks as one possible resulting product. It would have been prima facie obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of Schneider into the modified method of Tan because Tan suggests the method for use with data structures (Figs. 3 and 4), and Schneider's patterned magentic material provides a data structure which one would recognize as an alternative to the data pits of Tan.

10. **Claim 22** is rejected under 35 U.S.C. 103(a) as obvious over Tan (J. Vac. Sci. Technol. B 16(6), Nov/Dec 1998, pp. 3926-3928) in view of Davis (2002/0025408). Tan teaches the subject matter of Claim 1 above under 35 USC 102(b), or in the alternative, under 35 USC 103(a). **As to Claim 22**, Tan is silent to the thermosetting resist. However, Davis teaches a thermoset resist ([0053]). It would have been prima facie obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of Davis into that of Tan because (a) Davis suggests that thermoplastic and thermosetting resists are substitutable alternatives, or (b) Tan suggests fabrication of data structures, and Davis provides techniques specifically directed at fabrication of data structures.

11. **Claim 23** is rejected under 35 U.S.C. 103(a) as being unpatentable over Tan (J. Vac. Sci. Technol. B 16(6), Nov/Dec 1998, pp. 3926-3928) in view of Chou (USPN 5956216), Chou (USPN 6309580), and further in view of Chen (USPN 4786564). Tan, Chou ('216), and Chou ('580) teach the subject matter of Claim 7 above under 35 USC 103(a). **As to Claim 23**, Chou ('580) teaches removing the resist film (10:3-24) wherein a pattern of raised zones and recessed zones is formed in the base structure, but Tan, Chou ('216) and Chou ('580) appear to be silent to a continuous layer. However, Chen teaches a continuous layer which is provided as protection for the underlying alloy (7:67-8:7). It would have been prima facie obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of Chen into that of Tan in order to provide a hard layer to protect the underlying structures.

12. **Claim 24** is rejected under 35 U.S.C. 103(a) as being unpatentable over Tan (J. Vac. Sci. Technol. B 16(6), Nov/Dec 1998, pp. 3926-3928) in view of Chou (USPN 5956216), Chou (USPN 6309580), Chen (USPN 4786564), and further in view of Davis (2002/0025408). Tan, Chou ('216), Chou ('580), and Chen teach the subject matter of Claim 22 above under 35 USC 103(a). **As to Claim 24**, Tan is silent to the thermosetting resist. However, Davis teaches a thermoset resist ([0053]). It would have been prima facie obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of Davis into that of Tan because (a) Davis suggests that thermoplastic and thermosetting resists are substitutable alternatives, or (b) Tan suggests fabrication of data structures, and Davis provides techniques specifically directed at fabrication of data structures.

13. **Claims 1, 2, 8, 11, 12, and 22** rejected under 35 U.S.C. 103(a) as obvious over Davis (2002/0025408). **As to Claim 1**, Davis teaches a method comprising:

heating a stamper and a resist film ([0073] and [0074]);

imprinting the stamper into the resist film ([0076]);

separating the stamper from the resist film ([0076]);

cooling the resist film after separating (inherent in that other operations are subsequently performed).

Davis does not explicitly teach "separating the stamper from the resist film before there is any substantial cooling of the resist film". However, this limitation would have been prima facie obvious over Davis' teachings regarding the mold and resist temperatures.

Regarding the mold, Davis teaches that the mold temperature can be above the glass transition temperature of the material to be embossed ([0073], lines 8-10), preferably within 30C above the glass transition temperature ([0073], lines 10-13), and most preferably within about 10C above the glass transition temperature ([0073]), line 14. Furthermore, by *maintaining* the mold slightly above the glass transition temperature and separately heating the substrate to greater than the glass transition temperature, the embossing cycle time can be reduced by orders of magnitude ([0078]).

Regarding the resist, Davis teaches that the substrate is heated to a temperature between about 5C or less above the glass transition temperature for crystalline material, and greater than about 5C above the glass transition temperature for amorphous materials ([0073]). Furthermore, Davis teaches that the substrate can be *maintained* or changed as necessary to enable substrate release ([0075], lines 3-7).

Because the mold is maintained within about 10C above the glass transition temperature and the resist is at a temperature substantially similar to the glass transition temperature (5C or less above the Tg if crystalline, more than 5C above the Tg if amorphous, [0074]), there would not be any substantial cooling of the resist film before separation. Additionally, Davis teaches that the particular temperatures of both the mold and resist represent result-effective variables that should be optimized in order to (1) optimize replication, (2) enable substrate release from the mold, and (3) maintain the integrity of the surface features. Thus, the temperatures of both mold and resist represent result effective variables that should be optimized. See MPEP 2144.05 II and *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). **As to Claim 2**, see [0073],

[0077], [0074], [0078]. **As to Claim 8**, see [0077]. **As to Claims 11 and 12**, see [0073] and [0074]. **As to Claim 22**, see [0053]).

14. **Claims 3-6** are rejected under 35 U.S.C. 103(a) as being unpatentable over Davis (2002/0025408) in view of Chou (USPN 5956216). Davis teaches the subject matter of Claims 1 and 17 above under under 35 USC 103(a). **As to Claim 3**, Davis appears to be silent to the trenches and plateau areas, but Chou teaches trenches and plateaus (Fig. 8). It would have been prima facie obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of Chou into that of Davis a) in order to provide a magnetic material adapted for horizontal recording (4:54-64), and b) in order to provide a plurality of discrete elements of magnetic material, and c) because Davis clearly suggests the magnetic materials and method which Chou provides (Davis, par. [0080]). **As to Claim 4**, Chou teaches a substrate (Item 40, Figs. 4A-4D). **As to Claims 5 and 6**, Chou teaches selectively removing the resist film to form a pattern of areas that do not have the resist film thereon (Fig. 4C), and disposing a magnetic layer in the areas that do not have the resist film (Fig. 4D, Item 48).

15. **Claim 10** is rejected under 35 U.S.C. 103(a) as being unpatentable over Davis (2002/0025408). Davis teaches the subject matter of Claim 1 above under 35 USC 103(a). **As to Claim 10**, Davis appears to teach that the mold is maintained at its temperature, and thus would appear to be heated first. See [0078] in particular. However, the claimed order of heating represents a rearrangement in the order of steps, which is generally considered to be prima facie obvious in the absence of unexpected results. Here, it would have been prima facie obvious to

rearrange the order of steps in order to perform a procuring temperature on the resist ([0066]-[0070]) and to subsequently imprint the preheated resist.

16. **Claim 7** is rejected under 35 U.S.C. 103(a) as being unpatentable over Davis (2002/0025408) in view of Chou (USPN 5956216), and further in view of Chou (USPN 6309580). Davis and Chou ('216) teach the subject matter of Claim 5 above under 35 USC 103(a). **As to Claim 7**, Davis and Chou ('216) appear to be silent to the deliberate etching of the base structure using the patterned resist film. However, Chou ('580) teaches that recesses may be formed in the substrate (Fig. 8 and 10:41-51) using a patterned resist film produced by imprinting (Figs. 1A-1D). It would have been prima facie obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of Chou ('580) into that of Davis because Davis suggests application of material into the spaces between the resist, and because doing so would mechanically secure the deposited material into the substrate, rather than to the surface.

17. **Claim 9** is rejected under 35 U.S.C. 103(a) as being unpatentable over Davis (2002/0025408) in view Colburn (Solid State Technology, Vol. 44, Issue 7, (July 2001), pp. 67-77). Davis teaches the subject matter of Claim 1 above under 35 USC 103(a). **As to Claim 9,** Davis appears to be silent to the multilayer resist. However, Colburn teaches that bilayer resists are known in nanoimprint lithography (see Fig. 1 and pages 67-68). It would have been prima facie obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of Colburn into that of Davis because many resists are known to be used interchangeably

and are substitutable for each other, and the use of Colburn's resist in the Davis process is merely the substitution of one known nanoimprinting resist for another.

18. **Claims 13-16** are rejected under 35 U.S.C. 103(a) as being unpatentable over Davis (2002/0025408). Davis teaches the subject matter of Claim 12 above under 35 USC 103(a). **As to Claim 13**, Davis does not explicitly teach the "close proximity", however, it would have been prima facie obvious to keep the stamper in close proximity to the resist film in order to avoid heat loss during transfer. **As to Claim 14**, Davis appears to be silent to the exact temperatures. However, firstly Davis clearly recognizes that the particular temperatures of the stamper and resist represent result effective variables that the ordinary artisan would have optimized ([0073] and [0074]). See MPEP 2144.05 II and *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). Additionally, Davis suggests that the substrate (and resist) be heated to about 5 C above the glass transition temperature, and that the stamper should be within about 30 C over the glass transition temperature ([0073] and [0075]). **As to Claim 15**, Davis clearly teaches the resist and mold both be heated to a temperature very close to or at the glass transition temperature. **As to Claim 16**, Davis also teaches an embodiment wherein the resist is at a temperature slightly above the glass transition temperature, and the stamper is slightly below the temperature of the resist ([0073] and [0075]).

19. **Claim 21** is rejected under 35 U.S.C. 103(a) as being unpatentable over Davis (2002/0025408) in view Colburn (Solid State Technology, Vol. 44, Issue 7, (July 2001), pp. 67-77). **As to Claim 21**, Davis teaches a method comprising:

heating a stamper and a resist film to a first temperature at least that of a transition temperature of the resist film ([0073] and [0074]);

imprinting the stamper into the resist film ([0076]);

cooling the resist film to a second temperature above room temperature ([0076] and [0078]);

separating the stamper from the resist film ([0076]).

Davis teaches that the particular temperatures of both the mold and resist represent result-effective variables that should be optimized in order to (1) optimize replication, (2) enable substrate release from the mold, and (3) maintain the integrity of the surface features. Thus, the temperatures of both mold and resist represent result effective variables that should be optimized. See MPEP 2144.05 II and *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). In particular, Davis teaches that this could be accomplished by cooling the resist to any temperature below the glass transition temperature (which would be above room temperature), meeting the claimed temperature limitations.

Davis appears to be silent to the multilayer resist. However, Colburn teaches that bilayer resists are known in nanoimprint lithography (see Fig. 1 and pages 67-68). It would have been prima facie obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of Colburn into that of Davis because many resists are known to be used interchangeably and are substitutable for each other, and the use of Colburn's resist in the Davis process is merely the substitution of one known nanoimprinting resist for another.

As to Claim 18, Colburn teaches providing a substrate (Fig. 1) prior to heating.

20. **Claim 19** is rejected under 35 U.S.C. 103(a) as being unpatentable over Davis (2002/0025408) in view Colburn (Solid State Technology, Vol. 44, Issue 7, (July 2001), pp. 67-77), and further in view of Chou (USPN 5956216). Davis and Colburn teach the subject matter of Claim 21 above under 35 USC 103(a). **As to Claim 19,** Chou teaches selectively etching the resist film to form areas above the base that do not have the resist film thereon (Fig. 4C) and disposing a magnetic layer above the base layer in the areas that do not have the resist film (Fig. 4D). It would have been prima facie obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of Chou into that of Davis because Davis clearly suggests the method for magnetic media ([0052]), which is what Chou provides.

21. **Claims 23 and 24** are rejected under 35 U.S.C. 103(a) as being unpatentable over Davis (2002/0025408) in view of Chou (USPN 5956216), Chou (USPN 6309580), and Chen (USPN 4786564). Davis, Chou (‘216), and Chou (‘580) teach the subject matter of Claim 7 above under 35 USC 103(a). **As to Claim 23**, Chou (‘580) teaches removing the resist film (10:3-24) wherein a pattern of raised zones and recessed zones is formed in the base structure, but Davis, Chou (‘216) and Chou (‘580) appear to be silent to a continuous layer. However, Chen teaches a continuous layer which is provided as protection for the underlying alloy (7:67-8:7). It would have been prima facie obvious to one of ordinary skill in the art at the time of the invention to incorporate the method of Chen into that of Davis in order to provide a hard layer to protect the delicate magnetic structure. **As to Claim 24**, Davis teaches a thermoset resist ([0053]).

Response to Amendment

22. The declaration under 37 CFR 1.132 filed 14 May 2007 is insufficient to overcome the rejection of claim 1 based upon the references as set forth in the last Office action because (a) the claims are not commensurate in scope with the evidence submitted, and therefore fail the nexus requirement (See MPEP 716.01(b)), and (b) the declaration does not warn the declarant that willful false statements and the like are punishable by a fine or imprisonment, or both (See 35 USC 25). With respect to the nexus requirement, poor results were described at temperatures which were either too high or too low (Treves Decl., page 3, lines 15-18), but the claims do not recite the range where the unexpected result is found. It is noted, however, that if the range described by the Treves declaration were supported by the specification and distinctly claimed, the rejections of the independent claims under 35 USC 103(a) over Davis would be reconsidered.

23. Also note that the attached figure described at page 3 of the declaration appears to be absent. No figures appear to be attached to the declaration.

Response to Arguments

24. Applicant's arguments filed 11 February 2008 have been fully considered but they are not persuasive. <u>The arguments appear to be on the following grounds</u>:

a) Claim 1 is not an optimization of Davis because the maintenance, increase, or decrease in temperature cannot be assumed to also pertain to the specific time when the substrate is removed from the mold. Applicants submit that the only statements where Davis is specific to the temperature of the substrate describe a temperature below the glass transition temperature prior to removal of the mold.

b) A result-effective variable is narrowly interpreted to be only that which achieves a recognized result. Placing the substrate in the mold is not a result. The phrase generically lists all physically possible alternatives of conditions at any time after placing the substrate in the mold: (1) maintaining, (2) heating, and (3) cooling. This statement is tantamount to say that the temperature can be varied in any way after placement in the mold, which is actually an absence of disclosure. The only particular ever provided as a recognized result is to cool below Tg prior to removal from the mold.

c) Davis specifically teaches away from the claimed subject matter by stating that the mold cools the substrate.

d) Claim 1 is not an obvious re-ordering of prior art process steps. Davis states that the molded substrate is cooled to below the glass transition temperature. It is instead a process step conducted with a different set of conditions.

e) Evidence of unexpected result is provided herewith. This evidence rebuts the assertion made in the Office Action. It was determined to be a total surprise that there existed a temperature at which good embossing occurred without incurring reflow on opening the mold.

f) Incorporation of the method of Faircloth into that of Davis would render Davis inoperable for its intended purpose. Davis teaches imprinting a polymer that becomes a permanent topological feature of the substrate where postprocessing includes vapor deposition of metals (but Faircloth provides a lift-off process). The undercut produced by Faircloth’s bi-layer resist would be highly undesirable to Davis’ intended purpose of forming permanent metal-coated structures.

g) The sweepingly generalized statements in paragraphs [0073]-[0075] of Davis are made without regard to a multilayer resist.

Response:

a,c,d) While Davis does teach that "typically" the mold is cooled below the glass transition temperature, this is believed to be merely a preferred embodiment. Applicant points to the abstract and several claims for support for the conclusion that the claimed subject matter is not merely an optimization or reordering of the Davis process. In particular, attention was directed to Claim 11 of the Davis reference, but it is submitted that Claim 11 actually supports the Examiner's interpretation with respect to optimization. Claim 10 recites the same process steps also disclosed by this application including the steps of compressing the heated substrate in a mold, cooling the compressed substrate, and removing the cooled substrate from the mold. Claim 11 subsequently recites that the cooling of the compressed substrate is performed to below the glass transition temperature. It is submitted that if Claim 10 has a scope which is more broad than Claim 11, then it would appear that Claim 10 must necessarily include in its scope cooling the compressed temperature to a temperature above the substrate glass transition temperature.

Additionally or alternatively, reordering of prior art process steps is generally considered to be prima facie obvious. In this case, Applicants note that between temperatures of 115 C and 126 C, poor replication resulted (Treves Decl., page 3). If this defect is the same found at temperatures below the glass transition temperature, then it would appear that the order of cooling and removal does not produce any different result. It is only at temperatures above, but not abutting, the glass transition temperature that an unexpected result is asserted.

b) It is submitted that Davis describes several desired and recognized results of the temperature adjustment, including optimization of replication, enablement of substrate release from the mold,

and maintenance of the integrity of surface features (par. [0075]). Since the temperature adjustment is suggested as a means for improving the release between the substrate and mold, it is submitted that Davis is describing temperature adjustment throughout the process, and not merely at one limited moment. While Davis' description is tantamount to saying that the temperature can be varied in any way, it is directed at achieving these particular results, and is not so broad as to be meaningless.

e) Note the failure to satisfy the nexus requirement, and the failure to warn the declarant as required by 35 USC 25.

f) It is not believed to be the case that the process of Davis is limited to any particular article. As the claims, Abstract, and title of the Davis reference demonstrate, it is a generic shaping process without respect to any particular article. However, the Colburn reference is believed to be more pertinent to the Davis reference.

g) Note the Colburn reference above, which demonstrates that it is known to use a multilayer resist in a nanoimprint process similar to that of Davis.

Conclusion

25. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Zhang (Ph.D. Dissertation, Princeton University, 2001) is cited for the teachings recited on page 38. In particular, Zhang teaches that the resist is consolidated to a rigid solid by UV-cure or thermal cure for liquid polymer, <u>or</u> cooling temperature below the glass transition temperature for thermal plastic polymer. Thus, Zhang teaches that the UV or thermal cure is an alternative to cooling below the glass transition temperature as a means for consolidating the

resist. Since imprinting and thermal curing would appear to raise the temperature above the glass transition temperature of the material, and since one would have found it obvious to omit the cooling step (which is required only for thermoplastics), separation before cooling below the Tg would have been further obvious over the Zhang process.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MATTHEW J. DANIELS whose telephone number is (571)272-2450. The examiner can normally be reached on Monday - Friday, 8:00 am - 4:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Christina Johnson can be reached on (571) 272-1176. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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/Matthew J. Daniels/
Primary Examiner, Art Unit 1791
6/6/08